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☐ 1. Document ID: US 20020065648 A1

L11: Entry 1 of 7   File: PGPB   May 30, 2002

PGPUB-DOCUMENT-NUMBER: 20020065648
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020065648 A1

TITLE: Voice encoding apparatus and method therefor

PUBLICATION-DATE: May 30, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Amano, Fumio	Kawasaki		JP	

APPL-NO: 09/ 816032   [PALM]
DATE FILED: March 22, 2001

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	DOC-ID	APPL-DATE
JP	2000-361874	2000JP-2000-361874	November 28, 2000

INT-CL: [07] G10 L 19/00

US-CL-PUBLISHED: 704/216
US-CL-CURRENT: 704/216

REPRESENTATIVE-FIGURES: 5A

ABSTRACT:

A voice encoding method includes the steps of encoding a first frame that contains
a plurality of voice data into encoded parameters, locally decoding the encoded
parameters of the first frame into a second frame, performing a plurality of
interpolation recovery processes that generate respective frames approximating to
the first frame by using a frame or frames other than the first frame, comparing
the second frame with the frames approximating to the first frame generated by the
plurality of interpolation recovery processes, calculating a signal to noise ratio
of each of the frames approximating to the first frame by treating the second frame
as the signal, determining an index number that indicates an interpolation recovery
process which provides a highest signal to noise ratio, and multiplexing and
transmitting the index number with the encoded parameters.

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`| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D |`

☐ 2.   Document ID: US 5274741 A

L11: Entry 2 of 7   File: USPT   Dec 28, 1993

US-PAT-NO: 5274741
DOCUMENT-IDENTIFIER: US 5274741 A

TITLE: Speech coding apparatus for separately processing divided signal vectors

DATE-ISSUED: December 28, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Taniguchi; Tomohiko	Yokohama			JP
Tanaka; Yoshinori	Kawasaki			JP
Ota; Yasuji	Yokohama			JP
Amano; Fumio	Tokyo			JP
Unagami; Shigeyuki	Atsugi			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fujitsu Limited	Kawasaki			JP	03

APPL-NO: 07/ 515430   [PALM]
DATE FILED: April 27, 1990

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	1-107339	April 28, 1989

INT-CL: [05] G10L 9/02

US-CL-ISSUED: 395/2.31
US-CL-CURRENT: 704/222

FIELD-OF-SEARCH: 381/29, 381/40, 381/41, 381/43, 395/2, 395/2.31

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4817157	March 1989	Gerson	381/40
4868867	September 1989	Davidson et al.	381/31
5086471	February 1992	Tanaka et al.	381/36

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FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0125423	March 1984	EP	
53-147406	December 1978	JP	
58-204632	November 1983	JP	
60-237500	November 1985	JP	
61-62100	March 1986	JP	
61-220000	September 1986	JP	
62-133498	June 1987	JP	
2113055	December 1982	GB	
2117608	February 1983	GB	

OTHER PUBLICATIONS

Burton et al., "Isolated-Word Speech Recognition Using Multisection Vector Quantization Codebooks", Aug. 1985, pp. 837-849, IEEE Transactions on Acoustics, Speech and Signal Processing.
Copperi et al., "CELP Coding for High-Quality Speech at 8 kbit/s", IEEE, 1986, pp. 1685-1688.
European Search Report completed Aug. 10, 1990 by Examiner Berger at Vienna.
Sharad Singhal "On Encoding Filter Parameters for Stochastic Coders" pp. 1633-1636 1987 IEEE.
M. R. Schroeder & B. S. Atal "Code-Excited Linear Prediction (CELP) High-Quality Speech at Very Low Bit Rates" pp. 937-940 1985 IEEE.

ART-UNIT: 238

PRIMARY-EXAMINER: Fleming; Michael R.

ASSISTANT-EXAMINER: Doerrler; Michelle

ATTY-AGENT-FIRM: Staas & Halsey

ABSTRACT:

A speech coding apparatus includes multipliers and prediction filters which successively process a plurality of signal vectors obtained from an index $2.\text{sup}.M$ and dimension N code book to obtain a reproduced speech signal. Error detectors are provided which find the error between the input speech signal and reproduced speech signal. Evaluators are also provided which calculate the optimum signal vectors giving the smallest errors. The multipliers are connected to a reduced code book, which is constituted of n number of code book blocks of index $2.\text{sup}.M/n$ and dimension N/n (where n is an integer of two or more). There are n number of multipliers, n number of prediction filters, n number of error detectors, and n number of evaluators corresponding to the code book blocks.

7 Claims, 9 Drawing figures

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D|

☐ 3.   Document ID: US 5263119 A

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L11: Entry 3 of 7　　　　　　　　　File: USPT　　　　　　Nov 16, 1993

US-PAT-NO: 5263119
DOCUMENT-IDENTIFIER: US 5263119 A
** See image for Certificate of Correction **

TITLE: Gain-shape vector quantization method and apparatus

DATE-ISSUED: November 16, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Tanaka; Yoshinori	Kawasaki			JP
Taniguchi; Tomohiko	Yokohama			JP
Amano; Fumio	Tokyo			JP
Ohta; Yasuji	Yokohama			JP
Unagami; Shigeyuki	Atsugi			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fujitsu Limited	Kawasaki			JP	03

APPL-NO: 07/ 795668　　[PALM]
DATE FILED: November 21, 1991

PARENT-CASE:
This application is a continuation, of application Ser. No. 07/545,609, filed Jun. 29, 1990, now U.S. Pat. No. 5,086,471.

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	1-167397	June 29, 1989

INT-CL: [05] G10L 9/02

US-CL-ISSUED: 395/2.32
US-CL-CURRENT: 704/223

FIELD-OF-SEARCH: 381/29-40, 395/2, 375/122

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3631520	December 1972	Atal	364/513.5
4133976	January 1979	Atal et al.	381/47
4220819	September 1980	Atal	381/38
4472832	August 1984	Atal et al.	381/40
4791654	December 1988	DeMarca et al.	375/122

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4797925	January 1989	Lin	381/31
4817157	March 1989	Gerson	381/40
4868867	September 1989	Davidson et al.	381/36
4896361	January 1990	Gerson	381/40
4922508	May 1990	Moriya	375/34
4956871	September 1990	Swaminathan	381/31
4969192	November 1990	Chen et al.	381/31
4975958	December 1990	Hanada et al.	381/36

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
314018	October 1988	EP	
59-123892	July 1984	JP	
60-41100	March 1985	JP	
60-102699	June 1985	JP	
62-997	January 1987	JP	
62-31222	February 1987	JP	
63-87034	April 1988	JP	
63-271400	November 1988	JP	
64-4129	January 1989	JP	
1-191510	August 1989	JP	
1-243098	September 1989	JP	

OTHER PUBLICATIONS

Jasiuk et al. "Vector Sum Excited Linear Prediction (VSELP) Speech Coding at 8 KBPS", IEEE, 1990, pp. 461-464.
Schroeder, M. R. and Atal, B. S., "Code-Excited Linear Prediction (CELP): High-Auality Speech at Very Low Bit Rates", Proceedings of ICASSP 1985, pp. 937-940.
Davidson G. and Gersho. A., "Complexity Reduction Methods for Vector Excitation Coding", Proceedings of ICASSP 1986, pp. 3055-3058.
Sabin et al., "Product Code Vector Quantizers for Waveform and Voice Coding", IEEE Transactions on Acoustics, Speech, and Signal Processing, vol. ASSP-32, No. 3, pp. 474-488, 1984.
Saitoh et al., "Gain/Shape Vector Quantizer for Multidimensional Spherically Symmetric Random Source", Electronics and Communications in Japan, Part I, vol. 69, No. 8, pp. 102-111, 1986.

ART-UNIT: 238

PRIMARY-EXAMINER: MacDonald; Allen R.

ASSISTANT-EXAMINER: Doerrler; Michelle

ATTY-AGENT-FIRM: Staas & Halsey

ABSTRACT:

A gain-shape vector quantization apparatus is provided for encoding and decoding, to transmit and receive compressed speech signals. A selected plurality of vectors are read from a code book based upon an index signal. The vectors are added in an

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adder and synthesis filtered by a synthesis filter, in either order, to produce an output. This output is subtracted from an input speech signal to produce an error signal. An evaluation unit produces an <u>index</u> to select the plurality of vectors read from the code book memory based on the error signal in order to minimize this error signal. The evaluation unit produces gain adjusting signals which can be used to adjust gains of the vectors read from the code book. In an <u>encoder,</u> signals indicative of the gain adjusting signal and the <u>index</u> signal are transmitted by a transmitter of the <u>encoder</u> to send a quantized speech signal to a receiver of a decoder. In the decoder, after the signals indicative of the gain adjusting signal and the <u>index</u> are received by the receiver of the decoder, an <u>index</u> and gain adjusting signal is derived for use to control reading of vectors from a code book and gains thereon to reproduce the speech signal.

15 Claims, 8 Drawing figures

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De |

☐ 4.   Document ID: US 5261027 A

L11: Entry 4 of 7   File: USPT   Nov 9, 1993

US-PAT-NO: 5261027
DOCUMENT-IDENTIFIER: US 5261027 A

TITLE: Code excited linear prediction speech coding system

DATE-ISSUED: November 9, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Taniguchi; Tomohiko	Yokohama			JP
Tanaka; Yoshinori	Kawasaki			JP
Ohta; Yasuji	Yokohama			JP
<u>Amano; Fumio</u>	Tokyo			JP
Unagami; Shigeyuki	Atsugi			JP
Sasama; Akira	Fuji			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fujitsu Limited	Kawasaki			JP	03

APPL-NO: 07/ 997667   [PALM]
DATE FILED: December 28, 1992

PARENT-CASE:
This application is a continuation of application Ser. No. 07/545,197, filed Jun. 28, 1990, now abandoned.

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	1-166180	June 28, 1989
JP	1-168645	June 30, 1989

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JP   1-195302   July 27, 1989

INT-CL: [05] G10L 9/00

US-CL-ISSUED: 395/2
US-CL-CURRENT: 704/200

FIELD-OF-SEARCH: 381/29-40, 381/46-47, 381/51, 395/2

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3631520	December 1971	Atal	364/513.5
4133976	January 1979	Atal et al.	381/47
4220819	September 1980	Atal	381/38
4472832	August 1984	Atal et al.	364/513.5
4817157	March 1989	Gerson	381/40
4860355	August 1989	Copperi	381/36
4868867	September 1989	Davidson et al.	381/35
4991214	February 1991	Freeman et al.	381/38
5001758	March 1991	Galand et al.	381/40

OTHER PUBLICATIONS

Schroeder, M. R. and Atal, B. S. "Code-Excited Linear Prediction (CELP): High-Auality Speech at Very Low Bit Rates" pp. 937-940 Proceedings of ICASSP'85, 1985.
Davidson, G. and Gersho, A. "Complexity Reduction Methods for Vector Excitation Coding" pp. 3055-3058 Proceedings of ICASSP '86, 1986.
Signal Processing IV: Theories and Applications, Proceedings of EUSIPCO '88, Fourth European Signal Processing Conference, Grenoble, 5th-8th Sep. 1988, vol. II, pp. 859-862, North-Holland, Amsterdam, NL; D. Lin: Vector Excitation Coding Using a Composite Source Model.
ICASSP '89, 1989 International Conference on Acoustics, Speech, and Signal Processing, Glasgow, 23rd-26th May 1989, vol. 1, pp. 53-56, IEEE, New York, U.S.; A. Bergstrom et al.: Code-book Driven Glottal Pulse Analysis.
ICASSP '88, 1988 International Conference on Acoustics, Speech, and Signal Processing, New York, New York City, 11th-14th Apr. 1988, pp. 151-154, IEEE, New York, U.S.; P. Kroon et al.: Strategies for Improving the Performance of CELP Coders at Low Bit Rates, p. 153.
ICASSP'86, IEEE-IECEJ-ASJ International Conference on Acoustics, Speech, and Signal Processing, Tokyo, 7th-11th Apr. 1986, vol. 1, pp. 461-464, IEEE, New York, U.S.; D. Lin: A Novel LPC Synthesis Model Using a Binary Pulse Source Excitation.
IEEE Transactions on Acoustics, Speech, and Signal Processing, vol. ASSP-32, No. 4, Aug. 1984, pp. 851-858, IEEE, New York, U.S.; S. Y. Kwon et al.: An Enhanced LPC Vocoder With No Voiced/Unvoiced Unvoiced Switch.

ART-UNIT: 238

PRIMARY-EXAMINER: Fleming; Michael R.

ASSISTANT-EXAMINER: Doerrler; Michelle

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ATTY-AGENT-FIRM: Staas & Halsey

ABSTRACT:

A code excited linear prediction (CELP) type speech signal coding system is provided, a code vector obtained by applying linear prediction to a vector of a residual speech signal of white noise is stored in a code book. A pitch prediction vector obtained by applying linear prediction to a residual signal of a preceding frame is given a delay corresponding to a pitch frequency and added to the code vector. Use is made of an impulse vector obtained by applying linear prediction to a residual signal vector of impulses having a predetermined relationship with the vectors of the white noise code book. Variable gains are given to at least the above code vector and impulse vector, a reproduced signal is produced, and this reproduced signal is used for identification of the input speech signal. Thus, a pulse series corresponding to the sound source of voiced speech sounds is created.

36 Claims, 21 Drawing figures

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De |

☐ 5. Document ID: US 5151968 A

L11: Entry 5 of 7   File: USPT   Sep 29, 1992

US-PAT-NO: 5151968
DOCUMENT-IDENTIFIER: US 5151968 A

TITLE: Vector quantization encoder and vector quantization decoder

DATE-ISSUED: September 29, 1992

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Tanaka; Yoshinori	Kawasaki			JP
Taniguchi; Tomohiko	Yokohama			JP
Amano; Fumio	Tokyo			JP
Ohta; Yasuji	Yokohama			JP
Unagami; Sigeyuki	Atsugi			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fujitsu Limited				JP	03

APPL-NO: 07/ 562604   [PALM]
DATE FILED: August 3, 1990

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	1-202418	August 4, 1989

INT-CL: [05] G10L 3/00

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US-CL-ISSUED: 395/2; 381/31
US-CL-CURRENT: 704/200; 704/222

FIELD-OF-SEARCH: 364/513.5, 381/29-50, 395/2

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3631520	December 1971	Atal	395/2
4133976	January 1979	Atal et al.	381/47
4220819	September 1980	Atal	381/38
4472832	August 1984	Atal et al.	381/40
4827517	May 1989	Atal et al.	381/49
4852179	July 1989	Fette	381/29
4907276	March 1990	Aldersberg	381/31
4963030	October 1990	Makur	381/31
4963034	October 1990	Cuperman et al.	381/30
5023910	June 1991	Thomson	381/37

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
62-31222	February 1987	JP	
63-87034	April 1988	JP	
1-191510	August 1989	JP	
1-243099	September 1989	JP	

OTHER PUBLICATIONS

Schroeder, M. R. and Atal, B. S. "Code-Excited Linear Prediction (Celp): High-Auality Speech at very Low Bit Rates" pp. 937-940 Proceedings of ICASSP '85.
Davidson, G. and Gersho. A. "Complexity Reduction Methods for Vector Excitation Coding" pp. 3055-3058 Proceedings of ICASSP '86.

ART-UNIT: 231

PRIMARY-EXAMINER: Shaw; Dale M.

ASSISTANT-EXAMINER: Knepper; David D.

ATTY-AGENT-FIRM: Staas & Halsey

ABSTRACT:

An apparatus for compressing and decompressing speech signals. The encoder or decoder comprises a plurality of codebooks each controlling a plurality of indexed code vectors for a different frequency band. Each of the codebooks is provided with a synthesis filter for reproducing a signal wave shape based on a code vector provided by the corresponding codebook. The encoder or decoder further comprises an

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adder for computing a sum of signal wave shapes reproduced by the synthesis filters. This arrangement can reduce the memory size of each codebook used for an encoding or a decoding process and an amount of operations of the encoding or decoding process.

17 Claims, 6 Drawing figures

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De |

☐ 6.   Document ID: US 5115469 A

L11: Entry 6 of 7   File: USPT   May 19, 1992

US-PAT-NO: 5115469
DOCUMENT-IDENTIFIER: US 5115469 A
** See image for Certificate of Correction **

TITLE: Speech encoding/decoding apparatus having selected encoders

DATE-ISSUED: May 19, 1992

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Taniguchi; Tomohiko	Yokohama			JP
Iseda; Kohei	Kawasaki			JP
Okazaki; Koji	Kawasaki			JP
Amano; Fumio	Tokyo			JP
Unagami; Shigeyuki	Atsugi			JP
Tanaka; Yoshinori	Yokohama			JP
Ohta; Yasuji	Kawasaki			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Fujitsu Limited	Kawasaki			JP	03

APPL-NO: 07/ 460099   [PALM]
DATE FILED: February 8, 1990

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	63-141343	June 8, 1988
JP	1-61533	March 14, 1989

PCT-DATA:

APPL-NO	DATE-FILED	PUB-NO	PUB-DATE	371-DATE	102(E)-DATE
PCT/JP89/00580	June 7, 1989	WO89/12292	Dec 14, 1989	Feb 8, 1990	Feb 8, 1990

INT-CL: [05] G01L 5/00

US-CL-ISSUED: 381/36; 381/34
US-CL-CURRENT: 704/228; 704/219, 704/261

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FIELD-OF-SEARCH: 381/29-40, 364/513.5, 375/22-24, 375/34, 375/122

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3067291	December 1962	Lewinter	381/31
3903366	September 1975	Coulter	381/38
4005274	January 1977	Vagliani et al.	381/32
4303803	December 1981	Yatsuzuka	581/31
4546342	October 1985	Weaver et al.	375/122
4622680	November 1986	Zinser	381/31

ART-UNIT: 231

PRIMARY-EXAMINER: Kemeny; Emanuel S.

ASSISTANT-EXAMINER: Doerrler; Michelle

ATTY-AGENT-FIRM: Staas & Halsey

ABSTRACT:

Several encoders perform a local decoding of a speech signal and extract excitation information and vocal tract information from a speech signal for an encoding operation. The transmission rate ratio between the excitation information and the vocal tract information are different for each encoder. An evaluation/selection unit evaluates the quality of decoded signals subjected to a local decoding in each of the encoders, determines the most suitable encoders from among the several encoders based on the result of the evaluation, and selects the most suitable encoder, thereby outputting the selection result as selection information. The decoder decodes a speech signal based on selection information, vocal tract information and excitation information. The evaluation/selection unit selects the output from the encoder in which the quality of a locally decoded signal is the most preferable. When vocal tract information changes little, the vocal tract information is not output, thereby allowing for increased quality of information. As much of the surplus of unused vocal tract information as possible is assigned to a residual signal. Thus, the quality of a decoded speech signal is improved.

12 Claims, 8 Drawing figures

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequence | Attachments | Claims | KWIC | Draw De |

☐ 7. Document ID: EP 411655 A2

L11: Entry 7 of 7   File: EPAB   Feb 6, 1991

PUB-NO: EP000411655A2
DOCUMENT-IDENTIFIER: EP 411655 A2
TITLE: Vector quantization encoder and vector quantization decoder.

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PUBN-DATE: February 6, 1991

INVENTOR-INFORMATION:
NAME   COUNTRY
TANAKA, YOSHINORI   JP
TANIGUCHI, TOMOHIKO   JP
AMANO, FUMIO   JP
OHTA, YASUJI   JP

ASSIGNEE-INFORMATION:
NAME   COUNTRY
FUJITSU LTD   JP

APPL-NO: EP90114961
APPL-DATE: August 3, 1990

PRIORITY-DATA: JP20241889A (August 4, 1989)
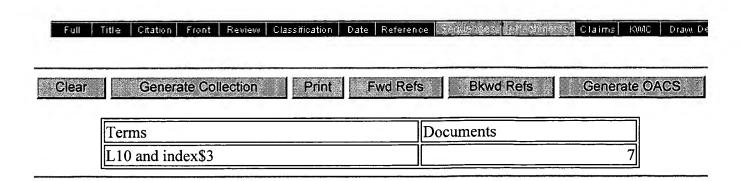

US-CL-CURRENT: 341/200; 704/207, 704/222
INT-CL (IPC): G10L 3/00; G10L 9/00; H03M 7/30; H04B 1/66
EUR-CL (EPC): G10L003/00; H03M007/30, G06T009/00

ABSTRACT:

CHG DATE=19990617 STATUS=O> A vector quantization encoder and a vector quantization
decoder compresses and decompresses speech signals, etc. The encoder or decoder
comprises a plurality of codebooks each controlling a plurality of indexed code
vectors of a different frequency band. Each of the codebooks is provided with a
synthesis filter for reproducing a signal wave shape based on a code vector
provided by the corresponding codebook. The encoder or decoder further comprises an
adder for computing a sum of signal wave shapes reproduced by the synthesis
filters. This arrangement can reduce the memory size of each codebook used for an
encoding or a decoding process and an amount of operations of the encoding or

decoding process.

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D |

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Terms	Documents
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